

System Specification

Data Fusion Completion Thread, Thor DP1

Checkout and Launch Control System (CLCS)

84K00302-002

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1.

Introduction

1.1 Data Fusion Completion Thread Overview.

Data Fusion involves computations using constants, measurement values, health values, or other fusion values. The result of a computation is a value which has a type equal to a data fusion Function Designator (FD) found in the CLCS Databank. Each fusion FD found in the databank has the same attributes that any other FD of the same type would have.

The Data Fusion Completion Thread establishes the CLCS capability to provide information using multiple FDs. This thread will support initial Data Fusion editing, loading, processing, distribution, system viewing, logging, and data retrieval.

The Data Fusion Completion Thread focuses on providing a comprehensive solution to performing data fusion. Requirements and statement of work items pertain to system fusion, but may also be applied to pseudos. It is the intent of the data fusion completion thread to examine pseudo calculations as well as system fusion. Many of the scripts created for system global fusion may be reused for pseudo calculations. Section 1.1.1 of this document attempts to define the differences between system fusion and pseudo calculations.

1.1.1 SLS Definitions relating to Data Fusion

Data fusion is the process of combining measurement data and RTPS system parameters into information that may be used in the same manner as measurement data.

A derived measurement FD is one whose value is created within the RTPS. Pseudo FDs are a measurement FD which is created within the RTPS by application software. Data fusion FDs are a special type of pseudo FD.

Pseudo FDs have many of the characteristics of command / measurement FDs (e.g., they are defined in the CLCS Data Bank, have On-Line Data Bank entries, may be used by data fusion, etc.). Pseudo FDs may be set or read by application SW, but otherwise are treated as measurement FDs within the RTPS.

Discriminators of the system FDs and pseudo FDs are listed in following chart.

System Fused FD and Pseudo FD Discriminators

| | System Fused FD | Pseudo FD |
|----------------------------|---|--------------------------------|
| Algorithm | Required | Optional |
| Algorithm Viewable | Required | Optional |
| Data Source | Change data only (run at data change rate) | Optional CVT or queued data |
| Parameter Changes Recorded | Required | Optional |

1.2 Data Fusion Completion Thread Concept

The Data Fusion thread can be divided into two segments, a user development segment, and a run time segment.

The user development segment involves:

- Off-line definition of Data Fusion algorithms (C++ or ControlShell applications).
- Verification of FDs against the valid FDs for any given TCID.
- A script to extract the algorithm, algorithm description and associated FDs to create an ASCII input file for the fusion viewer.
- A script to validate the algorithm does not contain any circular dependencies for published fused FDs.
- A script to validate system fusion only operates on queued (change) data.
- Users adding Fusion FDs to the Data Bank **as defined by Test Build and Control.**
- Adding fusion algorithms to a specified TCID.

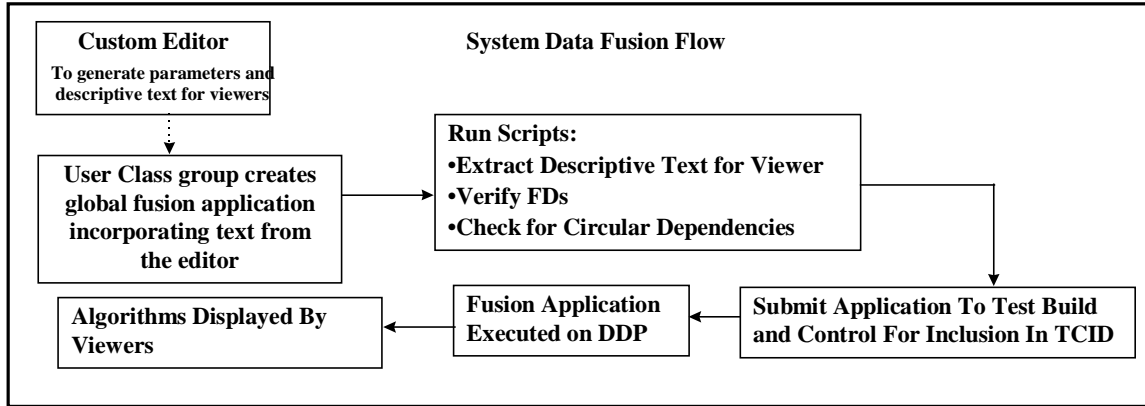
The run time segment consists of the following:

System fusion on the DDP

- Performing Data Fusion processing on specified FDs received at the DDP, by DDP applications which compute and publish application fusion FDs or pseudo FDs.
- Activates or inhibits publishing of fused FD values.
- Publishes FD changes from the producer.
- Fusion algorithms operating on every change of an FD.
- Algorithms, fused FDs, algorithm description, and associated FDs will be displayed on a CCWS.
- Fused FDs being recorded and made available for retrieval.

Fusion related activities executing on the CCWS

- Display fusion algorithms, fused FDs, algorithm description and associated FDs.
- Stores the results of the extraction of fusion algorithm descriptive text for on-line access for viewing.
- Runs applications which could create pseudo FDs for viewer support.



System data fusion requires that a user class group / RSYS submit an application which will be run on the DDP. This application must be created off-line by the user class group. A custom editor will be available for the user class group developers to assist in creating the application.

The custom editor will provide a GUI interface which allows the developer to insert the required information which will be used for viewer display. The editor will also allow a developer to scroll through the available FDs. Once the information is entered by the developer, clicking on a button will create an ASCII file, in the required format.

The ASCII file **contents** are required to be in all applications which run data fusion. The contents are used for FD verification against the TCID as well as creating a file for the system viewer to display the fusion algorithms and associated FDs. Use of the editor is not required, but is provided as a development tool for the application developer. A template of the contents of the ASCII file will be defined and may be used by the application developer if desired.

Once the application has been completed, several scripts will be run against the code by the Test Build group. The scripts will perform the following : 1) extract descriptive text for the viewer, 2) verify the FDs used against the valid FDs for the TCID, 3) check for circular dependencies of published FDs within the application, 4) and check that only queued (changed data) requests are made for system fusion. The same scripts will also be available to the user to run while developing the application code.

During the test configuration run, the fusion application is run on the DDP and the algorithms and associated FDs are displayed on the CCWS by system viewers.

An application which has been verified by the above scripts, will then be included in a TCID.

System data fusion will link with the appropriate system library to execute a potentially limited set of mathematical functions. For Thor and Atlas releases, all functions within the system mathematical library will be available to the system fusion developer. Certain functions may be removed from the system library and a link to a special system data fusion library may be implemented in the future. Limitations (if any) which are placed on the system fusion library will be determined by the COF group.

Fusion algorithms will continue processing during a specific test configuration run. A fused value may be inhibited. This is done by data distribution inhibiting the publishing of a given FD. An inhibited fused FD may be reactivated. The process of reactivating the publishing of a fused FD is also done by data distribution. Data distribution is responsible for the publishing of FD changes.

1.3 Data Fusion Thread Specification

Following shows the specific areas of how Data Fusion is supported.

1.3.1 Statement of Work (SOW)

- Provide user guide that lists the logical and mathematical functions provided by Data Fusion.
- Provide the Pre-Build Data Fusion Editor.
- Provide the capability for Fused FDs in the Test Build process.

Provided by Test Build and Control group.

- Provide an API for System Viewer with the minimum capability to access Fused FDs including the Fused FD value, associated input FD values, and the function being used to generate the Fused FD.

Provided by Data Fusion, Test Build and Control, Application Services, and System Viewers

- Provide a FD Design Tool to allow FDs of any type to be created, deleted, or modified. Allow these changes to be made to an Online Data Bank without using DBSAFE. Desktop Debug Environment ONLY)

Provided by Test Build and Control group.

- Create Enumerated FD data type supporting up to 256 states.

Provided by Test Build and Control group and Application Services.

- Provide performance data for Fusion overhead and functions for system modeling.

Data Fusion provides the data to the Performance Evaluation Support group to be analyzed.

- Provide the capability for the Data Fusion function to be initialized in both Operational and Desktop Debug Environment Configurations.
- Coordinate with possible baseline changes for allocation of Data Fusion.
- Provide logging of error, performance, and state change information.
- Baseline system messages using the System Message Catalog to include message and help text.

SOW items carried forward from Redstone

- Provide capability for performing data fusion with queued FDs.

Capability provided through Application Services for Thor.

- Provide mechanism to prioritize fusion algorithms.

A mechanism to prioritize algorithms will not be implemented in Thor.

1.3.2 Requirements from SLS

The following are a list of the SLS requirements pertaining to Data Fusion. The italicized text describes the interpretation or implementation which will satisfy the SLS requirement.

2.2.5.3.1 CLCS shall provide the capability to define, view, and execute the algorithms for performing data fusion.

The importance of this requirement is to provide a method for defining and viewing the algorithms used to calculate fused FDs.

2.2.5.3.2 A Fused Data Function Designator shall be recalculated whenever any of its input parameters change.

This requirement implies that the fusion will operate at the change data rate for system FDs.

2.2.5.3.3 When the value of a Fused FD changes the new value shall be transmitted to all users, and system or user applications at the System or Display Synchronous Rates.

This requirement is satisfied by Data Distribution distributing any FD change value.

2.2.5.3.4 The Data Fusion function shall allow activation and deactivation of Fused Data Function Designator Processing.

Interpreting “deactivation” to mean “inhibit”, this requirement is satisfied by Data Distribution activation/inhibiting all FDs including pseudo FDs.

2.2.5.3.5 The Data Fusion function shall provide the capability to set the value of a Fused FD.

This is interpreted as the ability to publish the value of a fused FD, which is satisfied by Data Distribution. The requirement to provide a debug capability to overwrite an FD is part of Data Distribution.

2.2.5.3.6 The RTPS Measurement FD Fusion function shall be fault tolerant.

System fusion fault tolerance will be handled by DDP redundancy and System Integrity. DDP redundancy and System Integrity will NOT be done for Thor. Algorithm fault tolerance will be handled TBD.

2.2.5.3.7 The RTPS Measurement FD Fusion function shall provide up to 5 levels of Data Fusion nesting.

A minimum of 5 levels of nesting will be tested for adherence to this requirement. However, levels of nesting will not be programmatically limited. It is up to the application program to code the required nesting. A data fusion pre-build script will be run to provide a check to ensure the application does not have circular dependencies for published FDs.

2.2.5.3.8 RTPS shall provide the capability to automatically maintain the values of Data Fusion FDs.

It is assumed that fused FDs will be treated as any other FD. The capability to maintain fused data values is provided by Data Distribution.

2.2.5.3.9 The RTPS Measurement FD Fusion function shall provide a mechanism to prioritize fusion calculations.

Priorities can be handled by the application or utilizing the UNIX priority system for establishing the priority. This capability will NOT be incorporated in the Thor delivery.

2.2.10.1.7 The RTPS shall record all Fused Data FD and Fused FD parameter changes to the SDC.

This requirement is implemented by Data Distribution.

1.3.3 Performance Requirements from the SLS

2.2.2.1.15 The Data Fusion function shall support the “system maximum data bandwidth” with one fusion calculation per end item FD change.

SLS Rationale: Although our goal is to execute the fusion algorithms within one System Synchronous Rate Time Period no limit requirement is included. During peak rate times the algorithm must support a lag in Fusion calculations. However, to assure that that time critical functions are executed in a timely fashion, Data Fusion will provide a priority mechanism (ref. Section 2.2.5 - System Support for User Applications/Data Fusion.).

1.3.4 Assumptions (ground rules)

- All interfaces both to and from Data Fusion will be through calls to FD Services.
- Data fusion is NOT responsible for authentication of FD writes. (*Note: Authentication is not done when data fusion values are generated in the DDP.*)
- The procedures utilized by system fusion for defining, documenting, and publishing data fusion FDs can also be utilized by EIMs and other applications.
- Parameter changes to fusion algorithms during real-time will be done through the use of pseudo FDs.

1.4

Data Fusion Thread Deliverables

The Data Fusion task for Thor is to complete development of the Data Fusion for the CLCS project.

Capabilities will be specified for editing, building, loading, processing, distribution, system viewing, logging, and retrieval.

The following deliverables will be provided for Thor:

| Deliverable | R&D Document | Code | API Manual | Users Guide |
|--------------------------------|--------------|----------|------------|-------------|
| Data Fusion | <u>x</u> | <u>x</u> | <u>x</u> | <u>x</u> |
| End Item Manager Services | <u>x</u> | <u>x</u> | <u>x</u> | <u>x</u> |
| Application Services | <u>x</u> | <u>x</u> | <u>x</u> | N/A |
| Test Build and Control | <u>x</u> | <u>x</u> | N/A | <u>x</u> |
| DBSAFE | <u>x</u> | <u>x</u> | N/A | <u>x</u> |
| SDC | N/A | <u>x</u> | N/A | N/A |
| System Services | N/A | <u>x</u> | N/A | <u>x</u> |
| System Viewers | <u>x</u> | <u>x</u> | N/A | <u>x</u> |
| OS Group | N/A | <u>x</u> | N/A | N/A |
| Performance Evaluation Support | N/A | <u>x</u> | N/A | N/A |
| COTS Tool | N/A | <u>x</u> | N/A | <u>x</u> |

1.5 Data Fusion Completion Thread Assessment Summary

This section contains the summary of the costs and labor involved in implementing the Data Fusion Completion Thread capabilities. It is divided into three sections. The first is a summary of the individual CI (CSCI and HWCI) labor assessments. The second is a summary of hardware costs. The third is a summary of procurement activities needed.

1.5.1 Labor Assessments

| No. | CSCI/HWCI Name | Thor LM | Changes covered in |
|-----------|---|-----------------------------|---|
| 1 | Data Fusion | 15.0 LM | Covered in this document |
| 2 | Data Distribution | 3.0 | Covered in this document |
| 3 | System Message Services | 0 | <u>Covered by System Services Thread</u> Completed in Redstone |
| 4 | System Viewer Services | 0 | Covered by the System Viewer Thread |
| 5 | Test Build and Configuration | <u>2 LM</u> 0 | Covered <u>in this document</u> by the TCID Build & Control Thread |
| 6 | Application Services | <u>16 LM</u> TBD | <u>Covered in this document</u> |
| 7 | DBSAFE | <u>2 LM</u> TBD | <u>Covered in this document</u> |
| <u>8</u> | <u>Application Services Processing (EIM Services)</u> | <u>0</u> | <u>Covered by Application Services Processing Thread</u> |
| <u>98</u> | Performance Evaluation Support | 0 | Covered by SE performance group |
| | TOTAL | 38.0 LM | |

1.6

Data Fusion Thread Schedule & Dependencies

1.6.1 Schedule

The following schedule is for the Data Fusion CSC. The dependency schedule follows in the next section.

| ID | Task Name | Start | Finish |
|----|---|----------|----------|
| | Data Fusion Key Dates | | |
| | Thor Assessment Kickoff | 7/23/97 | 7/23/97 |
| | Concept Design Panel Internal Review | 10/15/97 | 10/15/97 |
| | Concept Design Panel | 10/17/97 | 10/17/97 |
| | Thor Development | | |
| | Combined DP2/3 Internal Review | 11/11/97 | 11/11/97 |
| | Design Panel | 11/13/97 | 11/13/97 |
| | CSCI Unit Testing | 1/19/98 | 1/30/98 |
| | CSCI Development Integration Test | 2/2/98 | 2/13/98 |
| | CSCI Formal Integration Test | 2/16/98 | 2/20/98 |
| | Support System Integration Test | 2/23/98 | 3/27/98 |
| | Thor Development Complete | 3/27/98 | 3/27/98 |
| | <i>Regression test for beta version of ControlShell - Post Thor</i> | TBD | TBD |

1.6.2 Dependencies

| ID | CSCI Name | Key Dependencies | Need Date | Available Date |
|----|--|--|--|--|
| | Data Distribution | Distribute FDs - both input and fused. <u>Provide a method to publish a fused value.</u> | Completed in Redstone | Completed in Redstone |
| | System Message Services | Display system messages, error messages. | Completed in Redstone | Completed in Redstone |
| | Test Build and Control | Define procedure to add a FD to a given TCID. | 10/22/97 | 10/22/97 |
| | Test Build and Control | Define procedure to add an application to a given TCID. | 10/22/97 | 10/22/97 |
| | Test Build and Control | Provide details of how to <u>validate interface</u> with a TCID to determine the valid FDs for any given TCID. | 12/8/97 | 12/8/97 |
| | Application Services | Provide <u>an</u> API which allows <u>System Viewers</u> access to the ASCII file of algorithms and associated FDs. | 12/17/97 | 12/17/97 |
| | <u>Application Services</u> | Provide UDS support for (non-SDC) fusion viewer including APIs if requested. | 12/17/97 | 12/17/97 |
| | <u>Application Services</u> | Make changes (if required) to handle information that relates to the fact that the FD is fused | 12/17/97 | 12/17/97 |
| | <u>End Item Manger Services</u> End Item Manger Services | Partial delivery of FD components to TCID. | <u>12/17/97TBD</u> 12/17/97TBD | <u>12/17/97TBD</u> 12/17/97TBD |
| | System Viewer Services | Display FDs and algorithms. | 12/17/97 | 12/17/97 |
| | <u>Data Distribution</u> | <u>Provide a mechanism to activate and inhibit fused FD processing.</u> | 12/19/97 | 12/19/97 |
| | <u>System Services</u> | <u>Provide a comprehensive math library.</u> | 12/19/97 | 12/19/97 |
| | OPS CM | Provide capability to load and initialize system data fusion. | 12/19/97 | 12/19/97 |
| | OPS CM | Provide capability to load ASCII text file for data fusion viewer on all CCWS which have a data fusion viewer. | 12/19/97 | 12/19/97 |
| | <u>System Services</u> | <u>Provide</u> interface from DCN to SDC. | 1/9/98 | 1/9/98 |
| | DBSAFE | Provide a tool which allows FDs to be added to the OLDB without having to add the FDs to DBSAFE and TCID. | <u>1/9/98TBD</u> | <u>1/9/98TBD</u> |
| | DBSAFE | Create an FD type which allows for up to 256 enumerated types. | <u>1/9/98TBD</u> | <u>1/9/98TBD</u> |
| | End Item Manger Services | Create remainder of FD components for ControlShell applications. | <u>1/9/98TBD</u> | <u>1/9/98TBD</u> |
| | Application Services | Provide an API which allows access to queued <u>values</u> <u>components</u> for fusion processing. (Create FD Manager) | 2/1/97 | 2/1/97 |
| | Performance Evaluation Support | Gather and compile performance data for Fusion overhead and functions for system modeling. | 3/1/97 | 3/1/976 |

1.6.3 Data Fusion Thread Procurement

- Comprehensive math library provided by System Services
~~None.~~

1.7 Data Fusion Thread Simulation Requirements

Data Generator will be used to supply a predefined representation set and repeatable set, of data, to test system fusion algorithms. The requirement for the Data Generator has already been levied by Data Distribution.

1.8 Data Fusion Completion Thread Integration and System Test

Overview:

Data Fusion testing will use two environments:

1. User Fusion Development Environment (Test Case 1)
2. Fusion Execution / Run-Time Environment. (all other Test Cases)

Fusion algorithms will be created to verify the tools and processes provided to create Data Fusion executable code and viewable Fusion algorithms.

These Fusion algorithms will be executed on the DDP using recorded PC-GOAL data sent through the SIM Gateway. Viewers will be used to verify the values in the CVT for the DDP, CCP, and CCWS.

Testing Limitations: Limited data types from a single data stream will be used.

Test Case 1 - Define (and build) algorithm for performing Data Fusion.

Test Approach Summary:

The tools and processes described in the "System Data Fusion Flow" diagram in Section 1.2 of the Data Fusion Completion Thread Concept document will be used to create a fusion algorithm and submit it to Test Build and Control. A previously-submitted algorithm that was submitted to Test Build and Control and which has been included in the Thor TCID will be executed on the DDP and viewed from a CCWS in Test Case 3.

Dependencies:

- Thor TCID, with Fusion FDs defined
- Development W/S, with Data Fusion tools loaded

SLS Requirement # 2.2.5.3.1(define)

Test Case 2 - View algorithm for performing Data Fusion.

Test Approach Summary:

Use the Fusion Viewer to obtain Algorithms on the DDP (System Fusion)

Required Test Configuration / Dependencies (for Test Cases 2 - 8):

- Ops CM to Configure Flow Zone
- DDP and CCWS platforms
- RTCN and DCN
- Reliable Messaging / Network Services
- Data Source (PC-GOAL data for STS-TBD feeding into SIM G/W)
- Thor TCID, with Fusion FDs defined
- Data Distribution / CVT on DDP and CCWS
- TBD CVT Viewing tool for DDP and CCWS
- Data Fusion Algorithm Viewer

SLS Requirement # 2.2.5.3.1(view)

Test Case 3 - Fusion algorithm execution, value distribution and automatic updates.

Required Test Configuration / Dependencies for Test Cases 2 - n:

- All Dependencies listed in Test Case 2.

Testing Approach Summary:

Use the TBD playback PC-GOAL data stream from the TBD Gateway to provide input FDs with changing values. The data needs to provide FD value changes at known time periods, preferably several minutes apart.

2A Fusion Algorithm Execution

Execute a Fusion algorithm on the DDP. Use the TBD CVT monitoring tool to verify that Fusion algorithm executed and stored the Fusion FD value in the DDP's CVT.

2B Fusion Value Distribution

Using the same TBD CVT monitoring tool, verify the Fusion FD value(s) are distributed to all platforms (DDP and CCWS).

2C Fusion Values Maintained Automatically / Fusion Value Recalculation

Verify the value changes concurrently on the DDP and CCWS when a DDP Fusion algorithm changes in the DDP. Need to verify the queued interface (not polled) is being used [TBD].

SLS Requirement # 2.2.5.3.1(execute), 2.2.5.3.2, 2.2.5.3.3, 2.2.5.3.8

Test Case 4 - Fusion processing activation and deactivation.

Summary of Testing Approach:

Using the CVT monitoring tool, verify the Fusion FD's active / inactive status changed to inactive.

Using the CVT monitoring tool, verify the Fusion FD's value does not change when input FD value(s) change. Verify this for the DDP and CCWS.

Dependencies:

- All Dependencies listed in Test Case 2.
- Fusion Viewer or other tool for verifying Fusion algorithm activation / deactivation.

SLS Requirement # 2.2.5.3.4

Test Case 5 - Setting Fusion FD values.

Summary of Testing Approach:

Dependencies:

- All Dependencies listed in Test Case 2.

SLS Requirement # 2.2.5.3.5

Test Case 6 - Nested Fusion algorithms.

Summary of Testing Approach:

Dependencies:

- All Dependencies listed in Test Case 2.

SLS Requirement # 2.2.5.3.7

1.9 Data Fusion Thread Training Requirements

N/A.

1.10 Data Fusion Facilities Requirements

- The latest version of ControlShell must be installed in Houston as well as KSC. The beta version must also be available before the stated release date in January. A pre-release beta version which contains the capabilities and structures which are available in beta release would be acceptable for development purposes.
- Real-time software that supports setting the priority of processes must be available for the SGI operating system. TBD

1.11 Travel Requirements

| From | To | Reason | No. of People | Duration | Frequency |
|---------|---------|--|---------------|----------|-----------|
| Houston | KSC | Support design panels by Houston developers / managers | 2 | 3 days | 3 trips |
| Houston | KSC | On-site integration testing and system testing by Houston developers | 2 | 3 weeks | 1 trip |
| KSC | Houston | Coordination activities | 1 | 3 days | 2 trips |

1.12

Data Fusion Thread Action Items/Resolution

~~None. Details of the required GUI interface for the Data Fusion editor are not clear.~~

~~**Resolution:** Users of the Data Fusion editor will be skilled in coding. The users can enter the code for the algorithms via a UNIX editor and incorporate the code into a ControlShell component. An extensive GUI interface for the Data Fusion editor is not required. If the need arises in a future delivery for a more robust editor, those requirements will be documented and the work will be done for that future release.~~

~~Data Fusion currently shows development work for the FD_Manager. This development activity may be more appropriate to FD_Services who will be the interface to any applications code. If Data Fusion does not develop the code for the FD_Manager, another dependency will be required. That dependency will be on FD_Services. **Resolution:** Determination of who will complete this development activity will be completed through meetings in the next few weeks.~~

~~Some consultation with RTI may be necessary throughout the development of Data Fusion tasks. Currently, it is assumed that time will be available on an as needed basis through the RTI consultation time acquired by Application Software. This is an assumption and should be verified.~~

1.13 Issues

- ControlShell availability requires the Data Fusion testing for Thor be done using an application developed using the alpha version of ControlShell. Additional labor months to retest the CIT capabilities, when the beta version of ControlShell is available, will be required in the post-Thor timeframe.
- Dependencies for the capability to view algorithms and FDs from the SDC will not be available for Thor. This requirement needs to be carried forward to a post Thor thread.

2. CSCI Assessments

2.1 Data Distribution and Processing CSCI Assessment

Data Fusion CSC Work Required

- Basic Data Fusion editor. (see example below)
- Scripting which verifies FDs required for algorithms against a valid TCID.
- Script which checks for circular dependencies of published fused FDs in fusion applications.
- Script which extracts information from applications for displaying the algorithms, descriptions, and associated FDs.
- Provide [information for performance analysis group](#)~~an API for queued ControlShell components.~~
- Coordination of all CI development tasks to complete the data fusion thread.

System data fusion requires that a user class group / RSYS submit an application which will be run on the DDP. This application must be created off-line by the user class group. A custom editor will be available for the user class group developers to assist in creating the application.

The custom editor will provide a GUI interface which allows the developer to insert the required information which will be used for viewer display. The editor will also have a button which allows the developer to scroll through the available FDs, if desired. Once the information is entered by the developer, clicking on a button will create an ASCII file, in the required format, and place it in the UNIX clipboard. The developer can then paste the clipboard contents directly into his / her application code.

The ASCII clipboard file **contents** are required to be in all applications which run data fusion. The contents are used for FD verification against the TCID as well as creating a file for the system viewer to display the fusion algorithms and associated FDs. Use of the editor is not required, but is provided as a development tool for the application developer. A template of the contents of the ASCII file will be defined and may be used by the application developer if desired.

Once the application has been completed, several scripts will be run against the code. The scripts will perform the following : 1) extract descriptive text for the viewer, 2) verify the FDs used against the valid FDs for the TCID, 3) a check for circular dependencies of published fused values within the application, and 4) check that only queued (changed data) requests are made for system fusion.

An application which has been verified by the above scripts, will then be submitted to the Test Build and Control group for inclusion in the TCID.

During the run, the fusion application is run on the DDP and the algorithms and associated FDs are displayed on the CCWS by system viewers.

Data Fusion CSC will also provide data to support collection of performance data by the Performance Evaluation group.

Example of the Basic Fusion editor.

| | |
|--------------------|--|
| Name of Algorithm | |
| Fused FD | <input type="text"/> |
| Input FDs | <input type="text"/> |
| | <input type="button" value="Select FD"/> |
| | <input type="button" value="Create Form"/> |
| Associated FDs | <input type="text"/> |
| Algorithm Equation | <input type="text"/> |
| Description | <input type="text"/> |

The Data Fusion processing CSC will build a simple data fusion editor for use by anyone wishing to do data fusion. The editor will require the user to input the following items:

- Input FDs
- Fused FD

- Associated FDs
- [A numeric representation of the algorithm which can be displayed by System Viewers](#)
- Descriptive text about the algorithm or FD.

| <u>Function Name</u> | <u>CSCI Labor (LM)</u> | <u>% of CSC</u> |
|--|------------------------|-----------------|
| Basic Data Fusion Editor | 2.0 | |
| FD validation script | 1.0 | |
| Script to verify the fusion application submitted does not contain any circular dependencies for published FDs | 1.0 | |
| Script to extract information for display by system viewers | 1.0 | |
| Script to validate only changed data (queued) is in the system fusion. | 1.0 | |
| Collect performance data | 1.0 | |
| Coordinate all CI development to complete data fusion thread | 6.0 | |
| Create test tools for system data fusion | 2.0 | |
| TOTAL | 15.0 | |
| <i>Post Thor transition to beta version of ControlShell</i> | <i>TBD</i> | |

Lines of Code

TBD

Documentation

The following documentation will be provided:

Data Fusion User's Guide which documents functionality provided by the [Data Fusion Editor](#); details of inserting algorithms into a TCID; details of inserting FDs into the Data Bank and TCID; and details of the valid enumerated FD types (256 states).

Assumptions

[None](#) Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

Open Issue

None⁴.

2.2 Data Distribution CSC Assessment

Data Distribution must provide FDs and publish FDs via FD_Services which provides the interface for Data Fusion and Fusion done by End Item Managers. This capability was completed in the Redstone delivery and should be available for Thor.

[Data Distribution must also provide the capability to activate and inhibit fusion FD processing.](#)

| <u>CSCI Name</u> | <u>CSCI Labor (LM)</u> | <u>% of CSCI</u> |
|--|------------------------|------------------|
| Data Distribution - activate and inhibit | 3 LM | |

| <u>CSCI Name</u> | <u>CSCI Labor (LM)</u> | <u>% of CSCI</u> |
|----------------------|------------------------|------------------|
| fused FD processing. | | |

Assumptions

~~2. Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4 for dependency assumptions.~~

1. All data fusion FDs and associated algorithms must be a part of a TCID builds.
2. The Data Fusion CSCI will not support the modification (or inclusion of new) of fusion FDs or modification of fusion algorithms in the Real-Time environment.

Open Issues

None~~4.~~

2.3 System ~~Message~~ Services CSCI Assessment

System ~~message~~ ~~S~~services must provide the capability ~~a comprehensive math library for Data Fusion to write both system messages and error messages. This capability was completed in Redstone and should be available for Thor.~~

Provide interface to SDC from the DCN. (post-Thor requirement)

Assumptions

~~None. Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.~~

Open Issues

None~~4.~~

2.4 System Viewer Services CSCI Assessment

System viewers must provide a way to display the algorithm requested as well as the input FDs and the fused FDs which are associated with the algorithm. Include capability to view both CVT values (Thor requirement) and values from the SDC (post-Thor requirement).

Assumptions

~~None. Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.~~

Open Issues

None~~4.~~

2.5

Test Build and Control CSCI Assessment

Test Build and Control will also provide a tool which will allow FDs to be added to the OLDB without having to add the FDs to DBSAFE and the TCID Build.

CSCI Assessment

Example:

| CSCI Name | CSCI Labor (LM) | % of CSCI |
|------------------------|-----------------|-----------|
| Test Build and Control | 3 LM | |

Documentation

| Document Type | New/Update | Number of Pages |
|---------------------------------------|------------|-----------------|
| Requirements and Design Documentation | Update | TBD |
| Users Guide | Update | TBD |
| Test Procedure | Update | TBD |

Assumptions

none

Open Issues

The tool to add FDs to the OLDB will only be available in the Desktop Debug Environment. We need to understand how code that is used in this environment gets CMed and Released for use but not allowed in the real-time environment.

Test Build and Control will provide a function which will allow for the checking of function designators against the TCID and DBSAFE.

Example:

| <u>CSCI Name</u> | <u>CSCI Labor (LM)</u> | <u>% of CSCI</u> |
|-------------------------------|------------------------|------------------|
| <u>Test Build and Control</u> | <u>2 LM</u> | |

Documentation

| <u>Document Type</u> | <u>New/Update</u> | <u>Number of Pages</u> |
|--|-------------------|------------------------|
| <u>Requirements and Design Documentation</u> | <u>Update</u> | <u>TBD</u> |
| <u>Users Guide</u> | <u>Update</u> | <u>TBD</u> |
| <u>Test Procedure</u> | <u>Update</u> | <u>TBD</u> |

Assumptions

None.

Open Issues

None.

Create enumerated data type class for digital pattern FDs in DBSAFE.

Example:

| CSCI Name | CSCI Labor (LM) | % of CSCI |
|-----------|-----------------|-----------|
| DBSAFE | 2 LM | |

Documentation

| Document Type | New/Update | Number of Pages |
|---------------------------------------|------------|-----------------|
| Requirements and Design Documentation | Update | TBD |
| Users Guide | Update | TBD |
| Test Procedure | Update | TBD |

Assumptions

NoneRefer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

Open Issues

None.

1.1—Test Build and Control CSCI Assessment

Test Build and Control must provide the following items for the Data Fusion completion thread:

- ☐Details of how an API or user should interface with a specific TCID build to determine if the FD is valid for that TCID.
- ☐The procedure for adding or deleting an FD for a specific TCID.
- ☐The procedure for adding or deleting an algorithm for a specific TCID.
- ☐The procedure for adding or modifying the flat file created by Data Fusion for use by System Viewers to display the fusion algorithm and associated FDs.

Assumptions

Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

Open Issues

Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

2.6 Application Services CSCI Assessment

Application Services must provide a way to associate the algorithms and FDs to an FD object. Application Services may also be required to write an FD Manager which will manage queued data requests from any application or the generic system fusion function.

| Function Name | CSCI Labor (LM) | % of CSC |
|--|-----------------|----------|
| Provide API which allows access to the ASCII file of algorithms and associated FDs. | 4.5 LM | |
| Make necessary changes to FD Services to handle enumerated FD types. | 3.5 LM | |
| Provide FD Manager and APIs which allow access to queued values for fusion processing. | 8.0 LM | |

Assumptions

~~None~~ Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

Assumptions

Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

Open Issues

Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

1.1 — DBSAFE CSCI Assessment

DBSAFE must provide an FD type which allows for up to 256 enumerated types. See section 1.4 for more details.

Assumptions

Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

Open Issues

Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

Open Issues

~~None.~~

2.7 End Item Manager Services CSCI Assessment

End Item Manager Services must provide the FD components for ControlShell users. End Item Manager Services must also submit the FD components to the Test Build and Control group for inclusion into the TCID.

Assumptions

~~None~~ Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

Open Issues

~~None~~ Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

2.8 Performance Evaluation Support CSCI Assessment

Provide support in gathering and compiling data for Data Fusion overhead providing functions for system modeling support.

Assumptions

~~None~~ Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

Open Issues

~~None~~ Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

2.9 Real-Time OS CSCI Assessment

Provide real-time OS support for prioritizing system fusion applications.

| <u>CSCI Name</u> | <u>CSCI Labor (LM)</u> | <u>% of CSCI</u> |
|------------------|------------------------|------------------|
| OS group | TBD | |

Assumptions

~~None~~ Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

Open Issues

~~None~~ Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

2.10 SDC CSCI Assessment (post-Thor implementation)

Provide capability to retrieve values for a list of FDs at a certain GMT.

| <u>CSCI Name</u> | <u>CSCI Labor (LM)</u> | <u>% of CSCI</u> |
|------------------|------------------------|------------------|
| SDC group | TBD | |

Assumptions

~~None~~ Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

Open Issues

~~None~~ Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

2.11 OPS CM CSCI Assessment

Provide capability load and initialize system fusion applications in the DDP. Provide capability to load the Data Fusion ASCII text file, which describes the fusion algorithm and associated FDs, on any CCWS which has a fusion viewer.

| <u>CSCI Name</u> | <u>CSCI Labor (LM)</u> | <u>% of CSCI</u> |
|------------------|------------------------|------------------|
|------------------|------------------------|------------------|

| <u>CSCI Name</u> | <u>CSCI Labor (LM)</u> | <u>% of CSCI</u> |
|------------------|------------------------|------------------|
| OPS CM group | TBD | |

Assumptions

~~None~~ Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

Open Issues

~~None~~ Refer to the Data Fusion Thread Action Items/Resolutions in Section 1.4.

3. COTS Products Dependencies

3.1 SW Products Dependency List

ControlShell 6.0 has been selected as the tool utilized for the generic Data Fusion engine. The current version of ControlShell 6.0 (utilized for Redstone) is a pre-release alpha version.

4. HWCI Assessments

Not Applicable